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(54) **MULTILAYER CERAMIC CAPACITOR AND BOARD HAVING THE SAME MOUNTED THEREON**

USPC 361/301.4, 321.1, 321.3, 306.3, 303
See application file for complete search history.

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H01G 4/012 (2006.01)
H01G 4/12 (2006.01)
H01G 4/228 (2006.01)

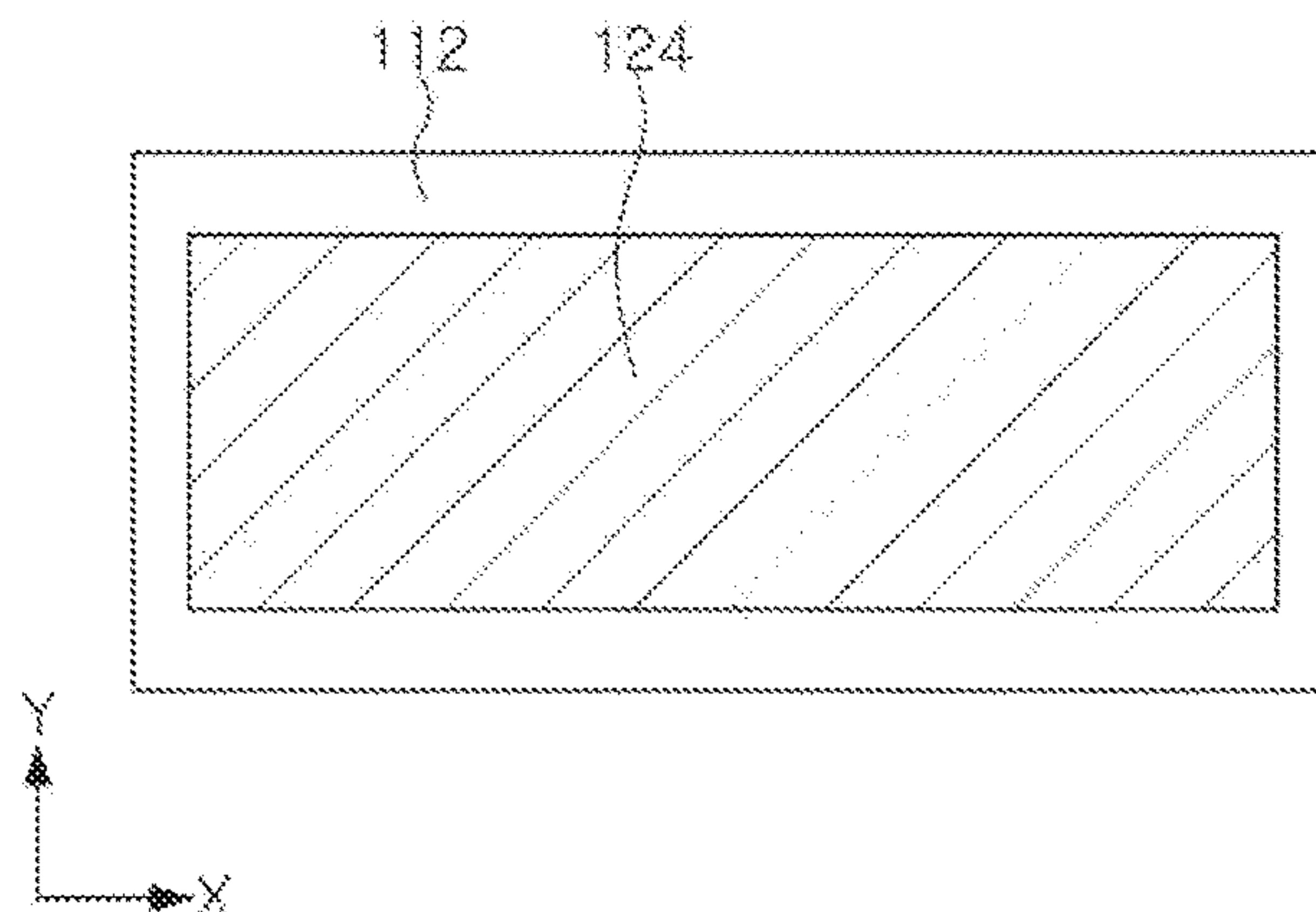
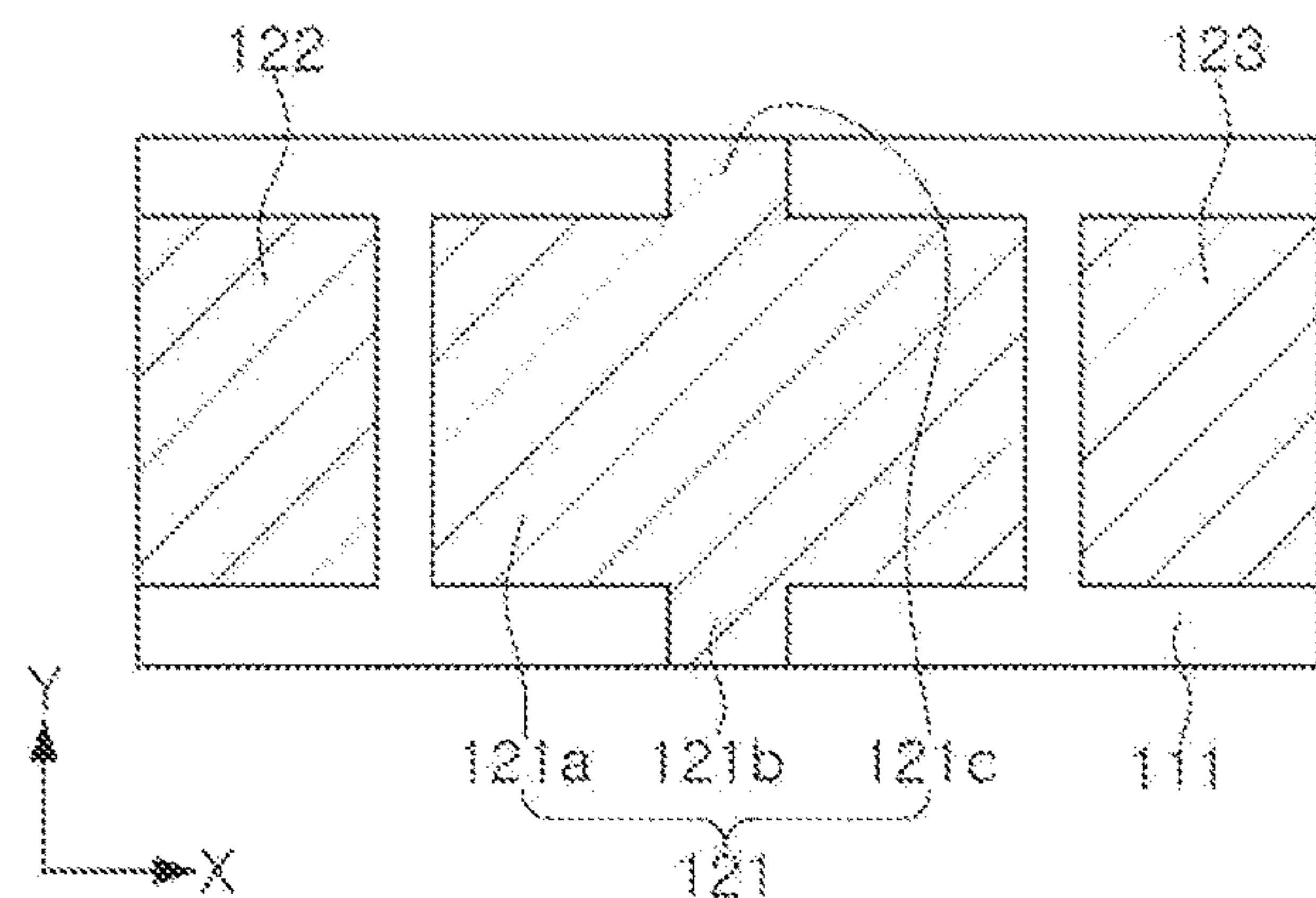
(57) **ABSTRACT**

(52) **U.S. Cl.**
CPC **H01G 4/30** (2013.01); **H01G 4/012** (2013.01); **H01G 4/12** (2013.01); **H01G 4/228** (2013.01)

A multilayer capacitor includes a capacitor body including first and second dielectric layers and internal electrodes, and including first to sixth surfaces; first and second external electrodes disposed on the fifth and sixth surfaces; and third and fourth external electrodes disposed on the third and fourth surfaces. The internal electrodes include: a first internal electrode disposed on the first dielectric layer and connected to the first and second external electrodes; a second internal electrode disposed on the first dielectric layer and connected to the third external electrode; a third internal electrode disposed on the first dielectric layer and connected to the fourth external electrode; and a fourth internal electrode disposed on the second dielectric layer and overlapping at least a portion of the first to third internal electrodes.

(58) **Field of Classification Search**
CPC H01G 4/30; H01G 4/12; H01G 4/228; H01G 4/005; H01G 4/012

17 Claims, 7 Drawing Sheets



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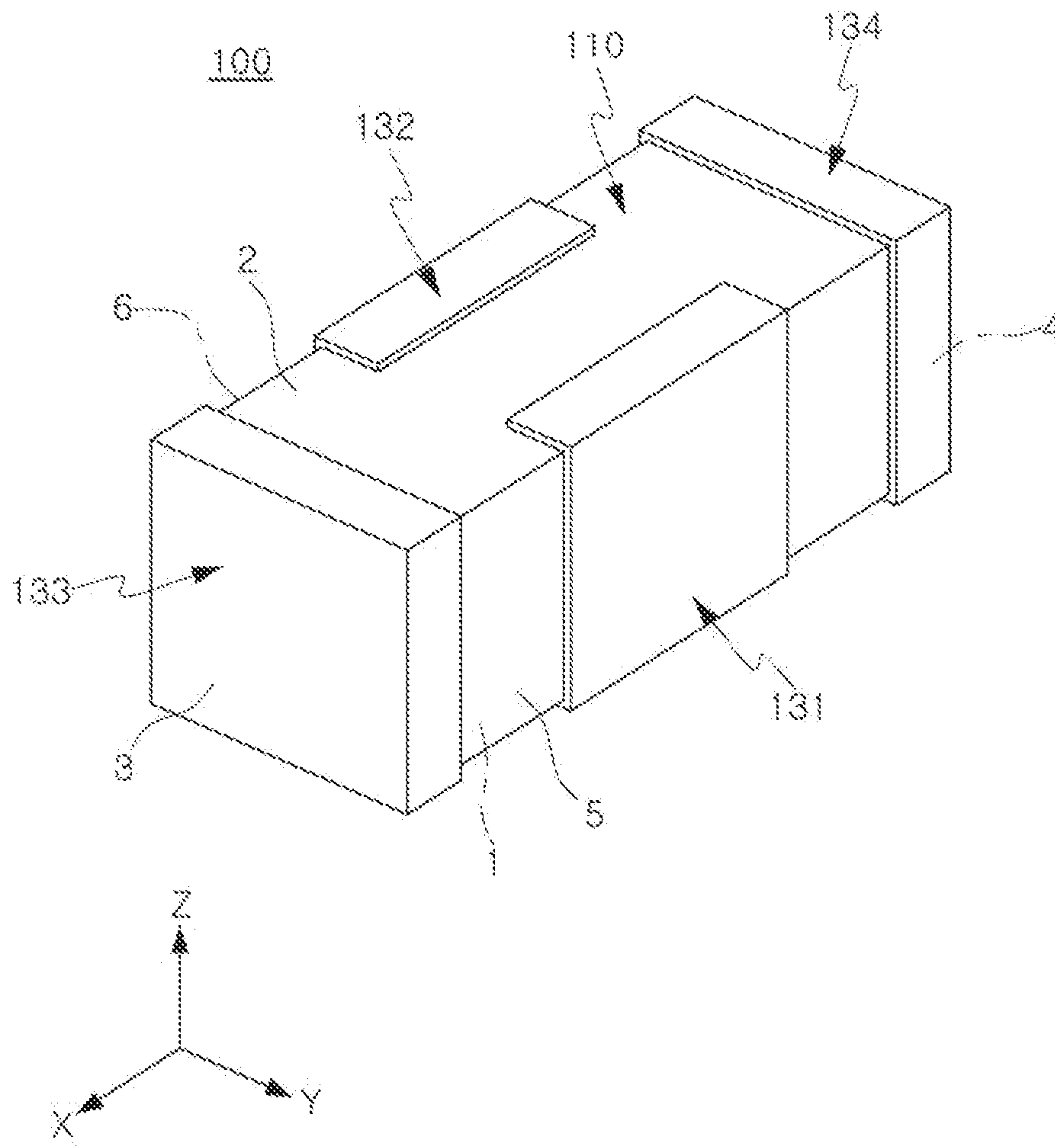


FIG. 1

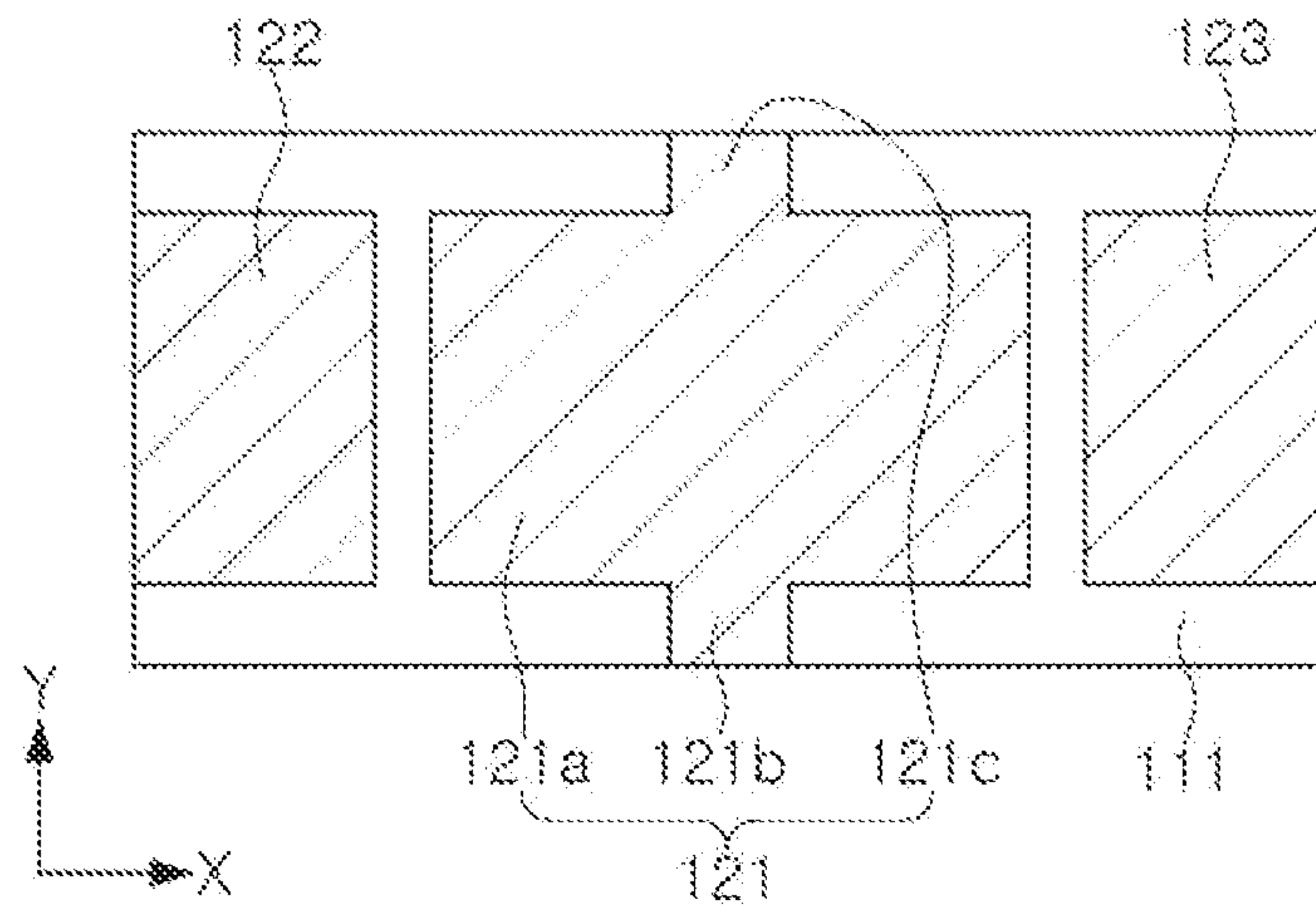


FIG. 2A

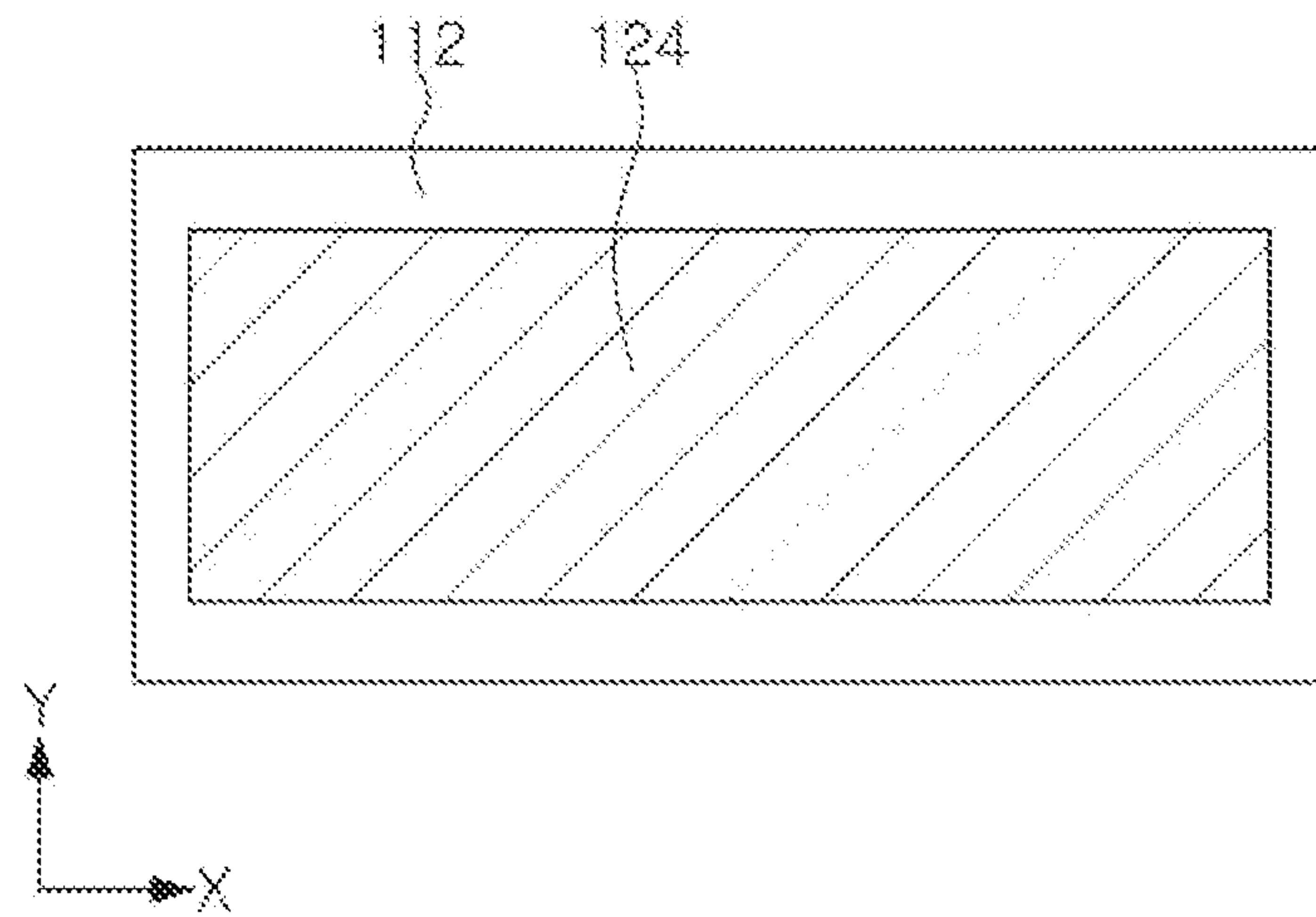


FIG. 2B

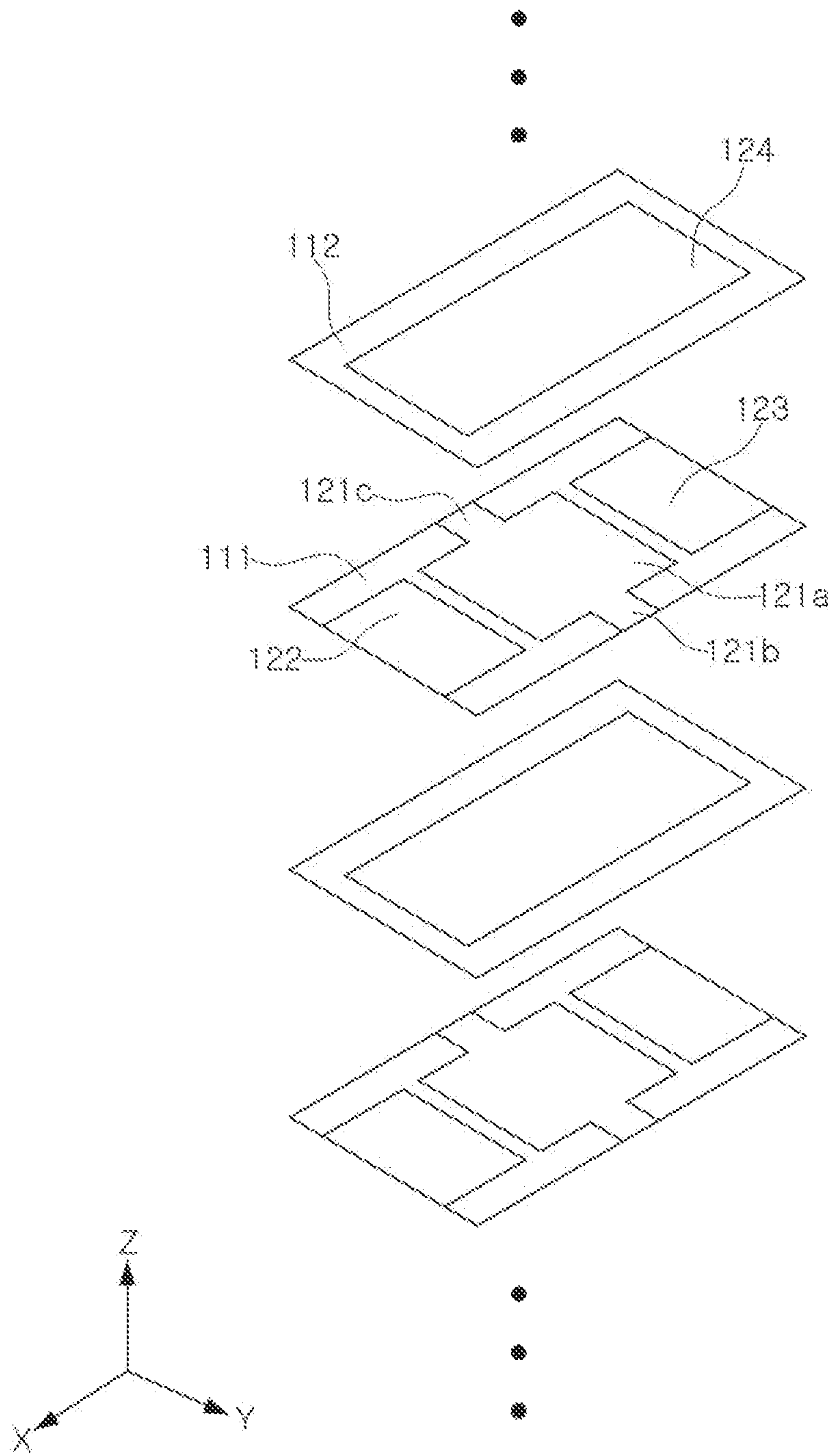


FIG. 3

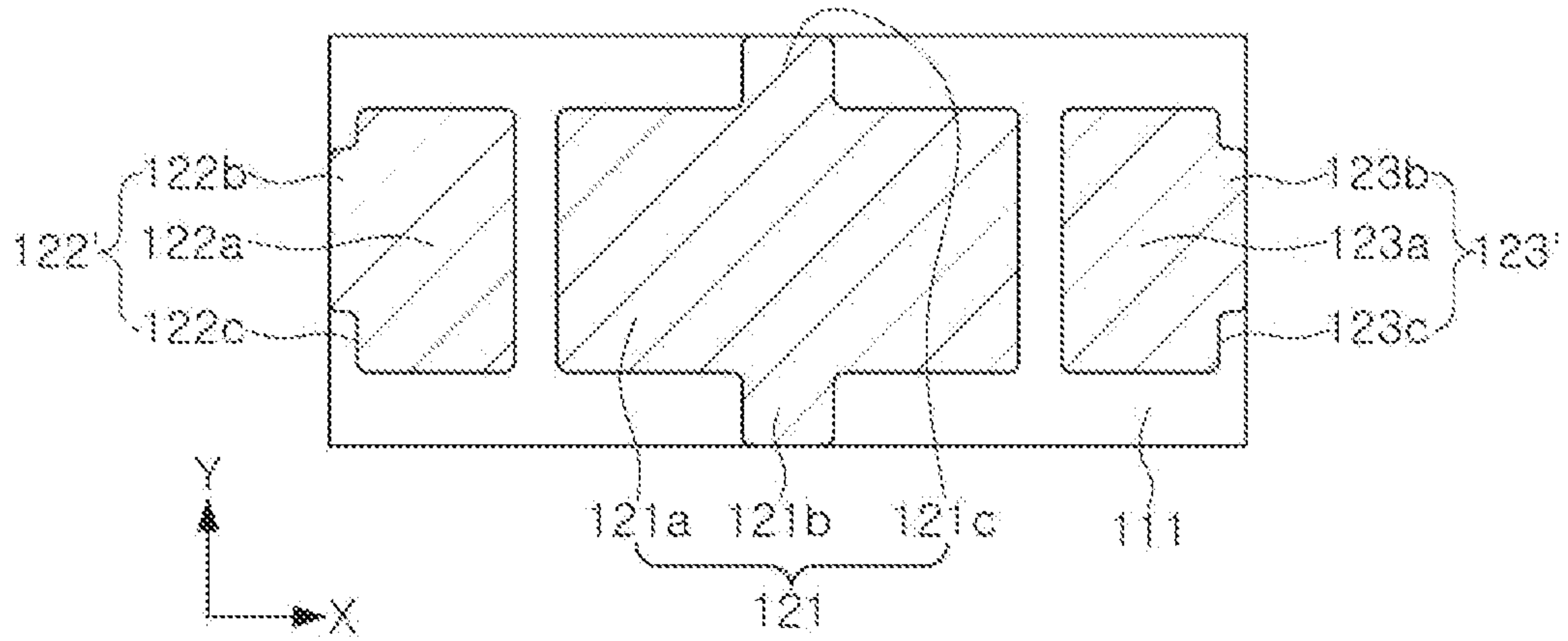


FIG. 4

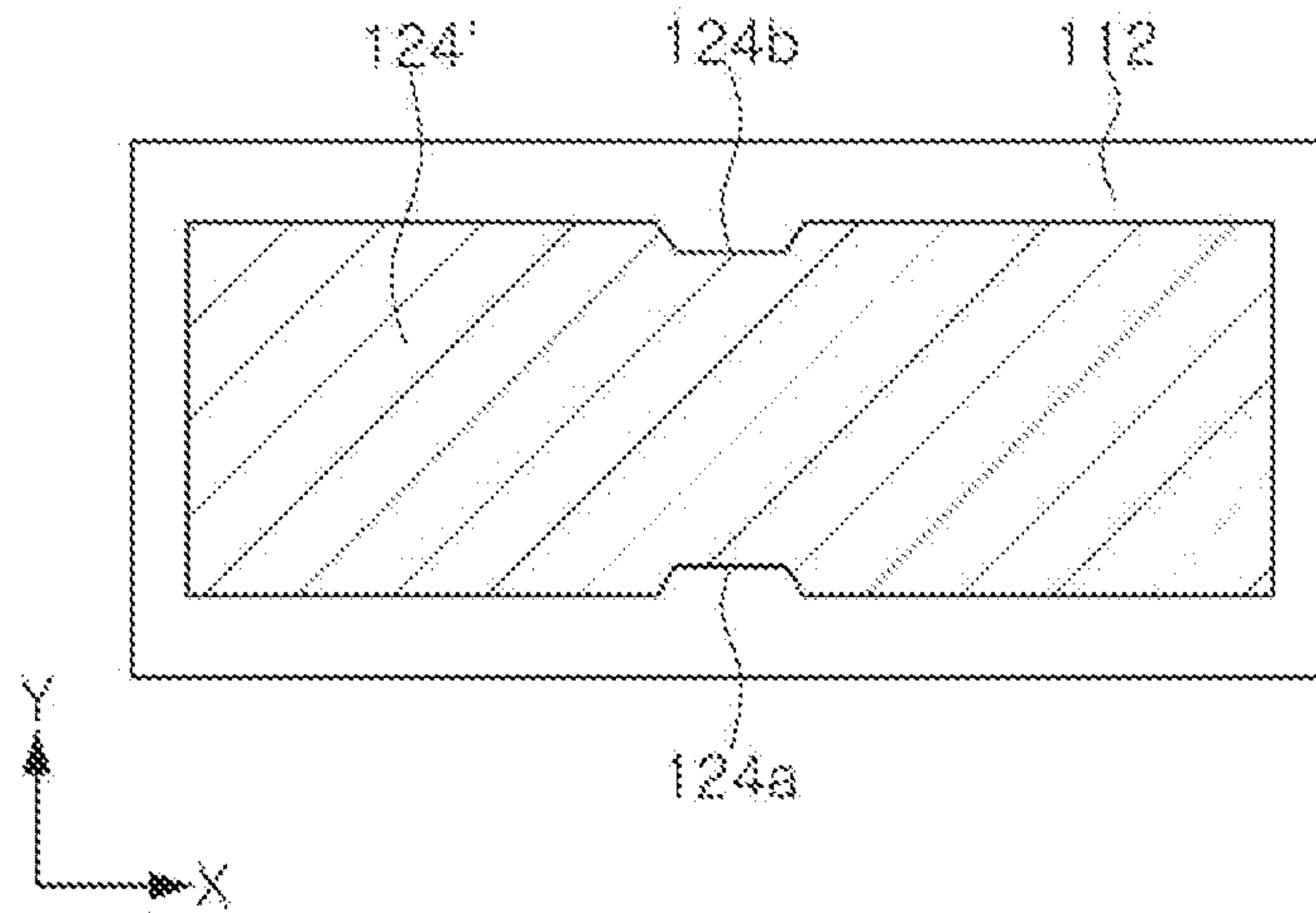


FIG. 5

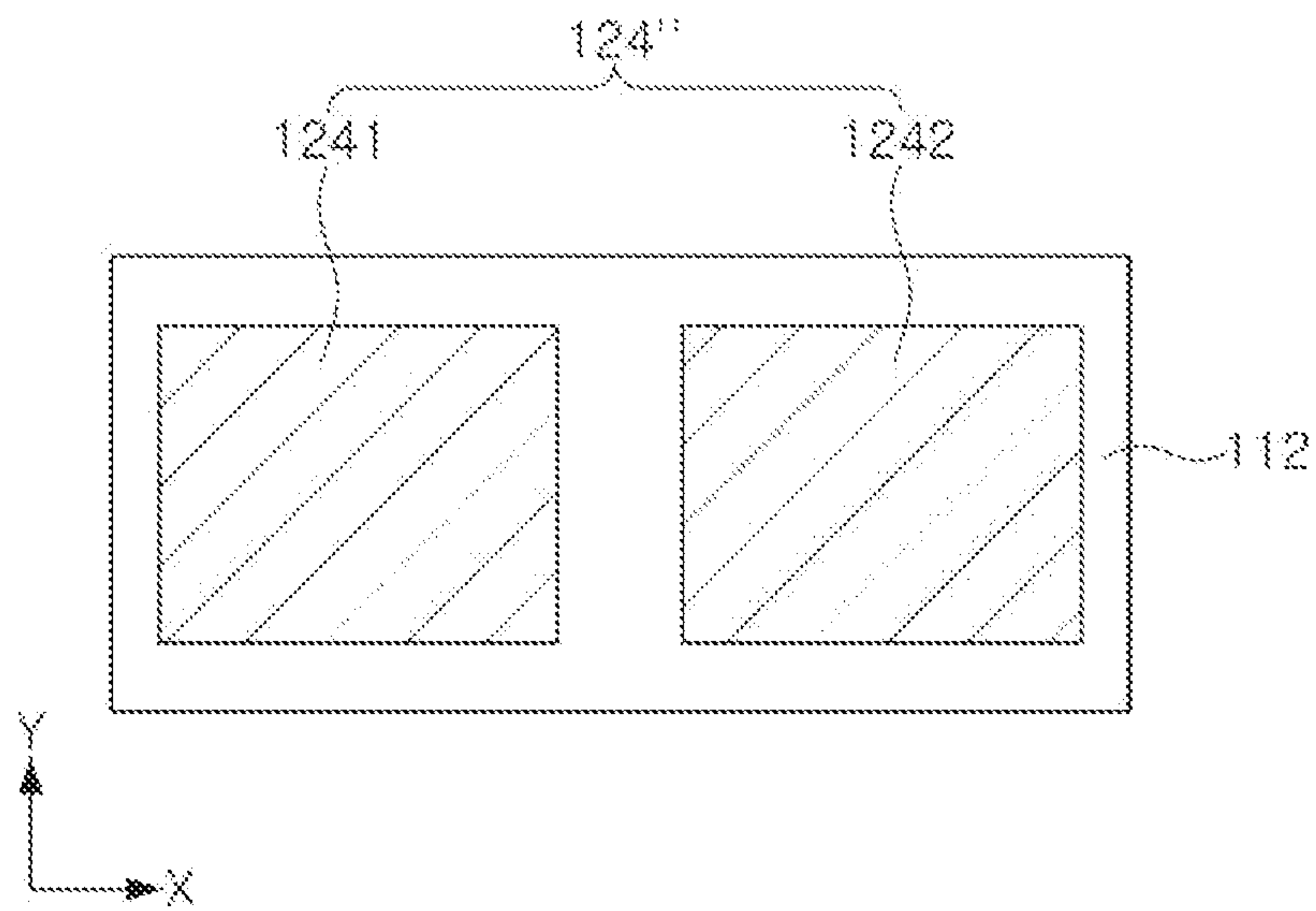


FIG. 6

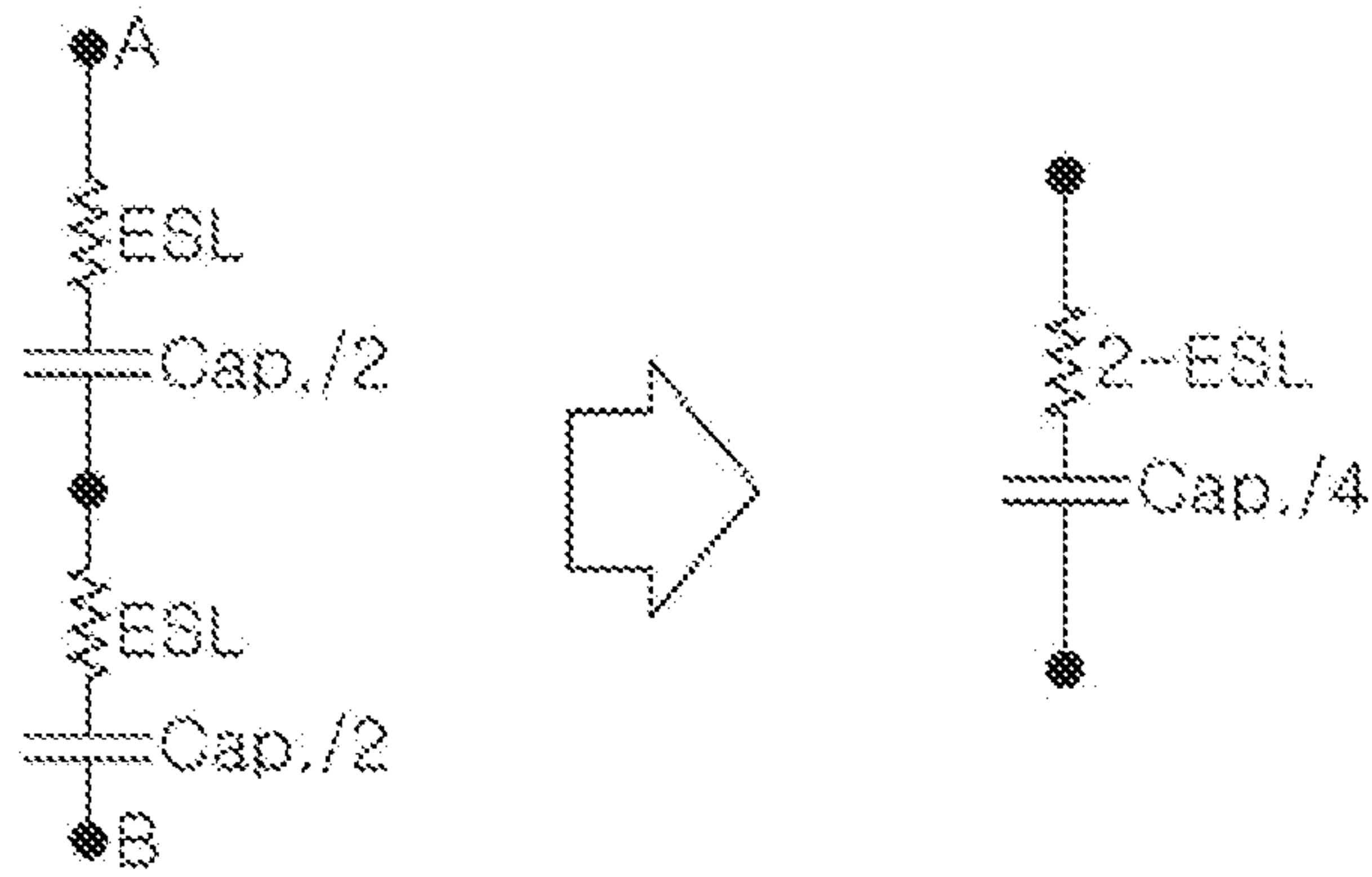


FIG. 7

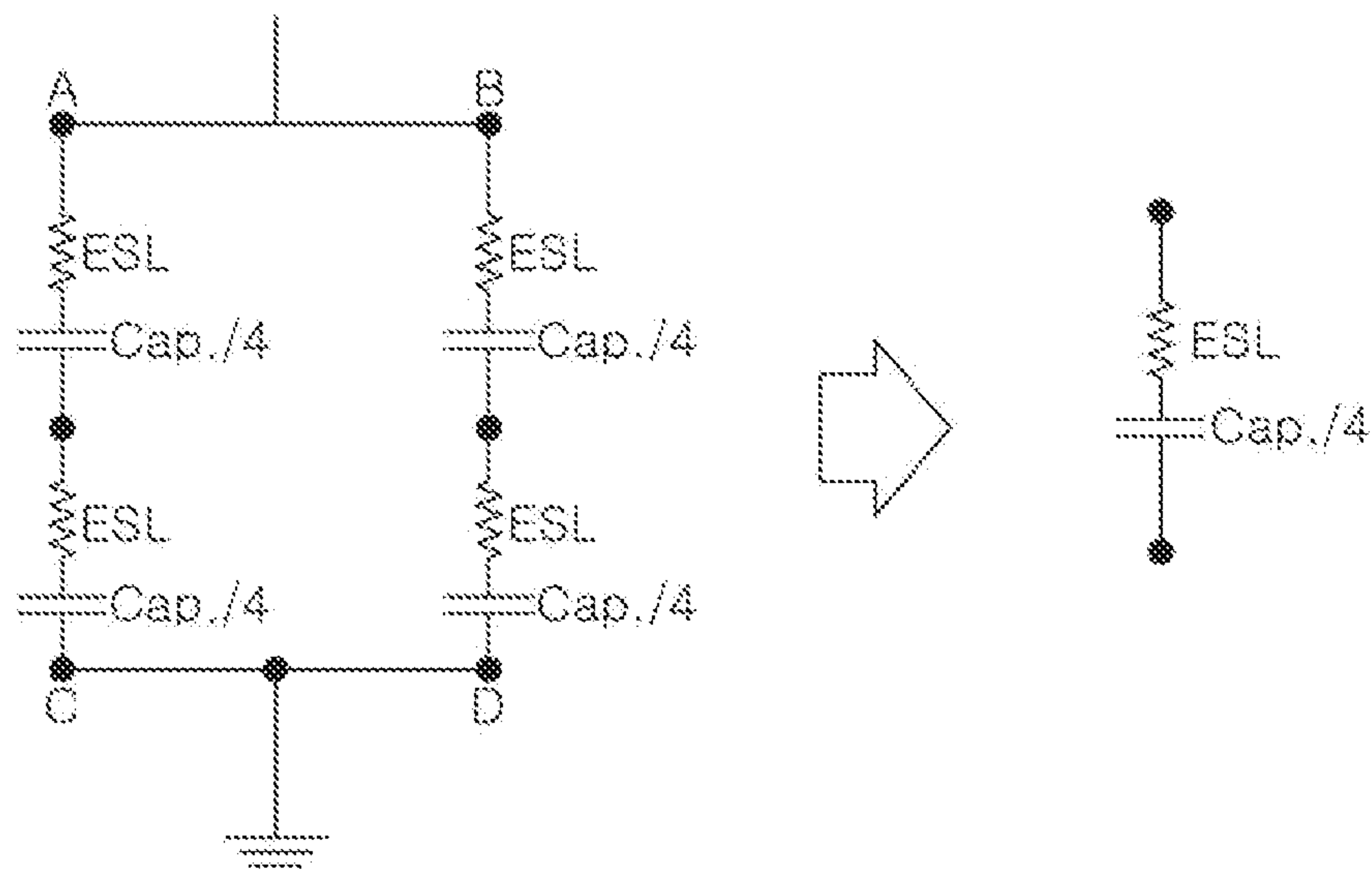


FIG. 8

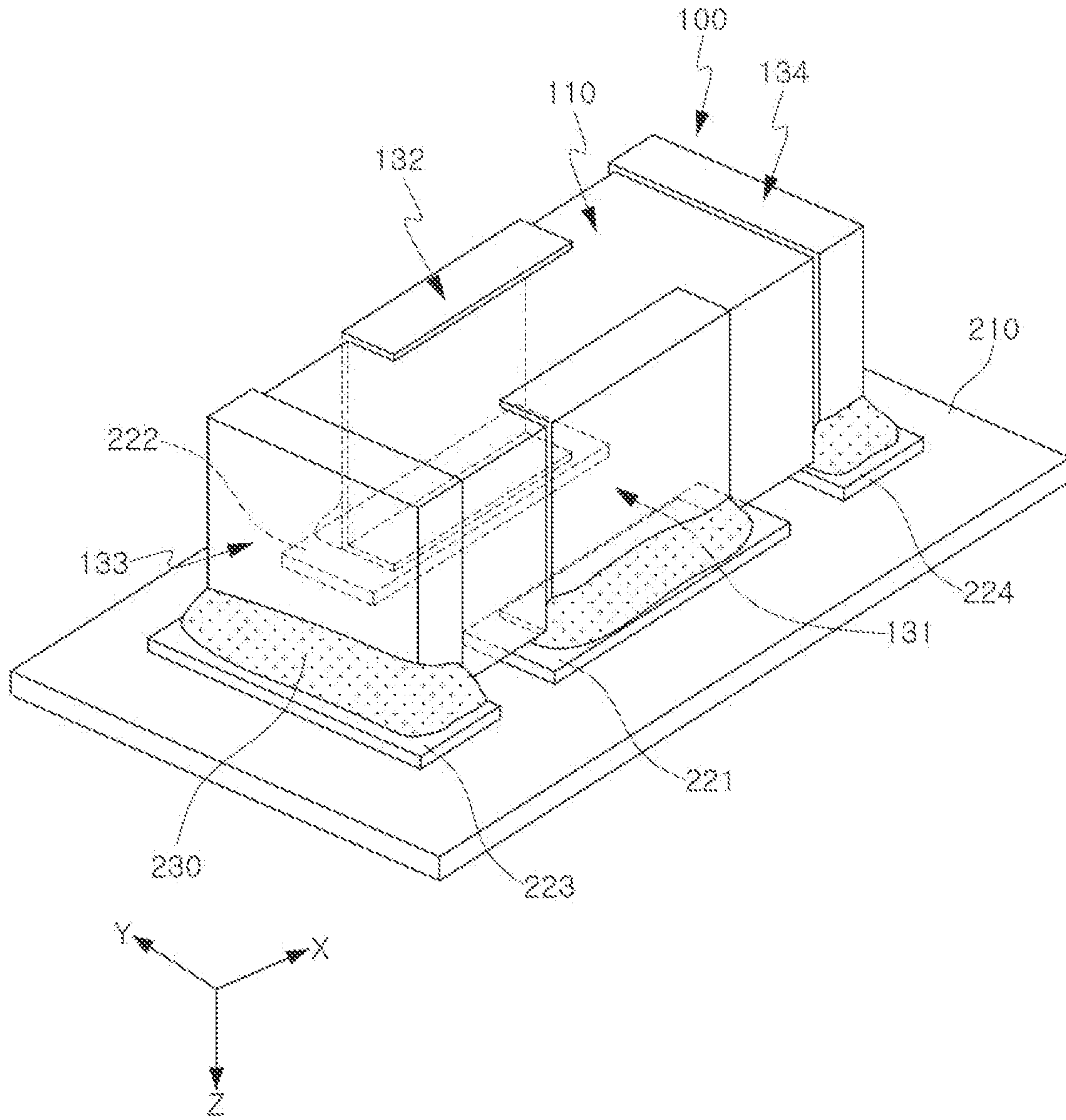


FIG. 9

**MULTILAYER CERAMIC CAPACITOR AND
BOARD HAVING THE SAME MOUNTED
THEREON**

CROSS-REFERENCE TO RELATED
APPLICATION(S)

This application claims benefit of priority to Korean Patent Application No. 10-2020-0159976 filed on Nov. 25, 2020 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

The present disclosure relates to a multilayer ceramic capacitor and a board having the same mounted thereon.

BACKGROUND

A multilayer ceramic capacitor is an electronic component applied to electronic devices within various fields.

Multilayer ceramic capacitors may be classified as a high voltage type multilayer ceramic capacitor, a low ESL type multilayer ceramic capacitor, an embedded type multilayer ceramic capacitor, or an improved bending strength type multilayer ceramic capacitor according to electrical properties thereof.

Recently, a multilayer capacitor having low equivalent series inductance (ESL) has been necessary to reduce ripples in a power current.

SUMMARY

An aspect of the present disclosure is to provide a multilayer capacitor having a high withstand voltage and implementing low ESL properties, and a board including the same mounted thereon.

According to an aspect of the present disclosure, a multilayer capacitor includes a capacitor body including first and second dielectric layers and a plurality of internal electrodes alternately laminated, and including first and second surfaces opposing each other, third and fourth surfaces opposing each other and connected to the first and second surfaces, and fifth and sixth surfaces opposing each other and connected to the first and second surfaces and the third and fourth surfaces; first and second external electrodes disposed on the fifth and sixth surfaces of the capacitor body, respectively; and third and fourth external electrodes disposed on the third and fourth surfaces of the capacitor body, respectively. The internal electrodes include: a first internal electrode disposed on the first dielectric layer and connected to the first and second external electrodes; a second internal electrode disposed on the first dielectric layer, spaced apart from the first internal electrode, and connected to the third external electrode; a third internal electrode disposed on the first dielectric layer, spaced apart from the first internal electrode, and connected to the fourth external electrode; and a fourth internal electrode disposed on the second dielectric layer, spaced apart from the first to fourth external electrodes, and overlapping at least a portion of the first to third internal electrodes.

The first internal electrode may include a first body portion overlapping a portion of the fourth internal electrode; and first and second lead portions extending from the first body portion toward the fifth and sixth surfaces of the capacitor body, respectively.

The second internal electrode may have at least one first cutout portion at a front end, adjacent to the third surface of the capacitor body in a direction perpendicular to the third surface of the capacitor body, and the third internal electrode may have at least one second cutout portion at a front end, adjacent to the fourth surface of the capacitor body in a direction perpendicular to the fourth surface of the capacitor body.

The second internal electrode may have a first cutout portion on at least one corner, and the third internal electrode may have a second cutout portion on at least one corner.

The second internal electrode may include a second body portion overlapping a portion of the fourth internal electrode, and a third lead portion extending from the second body portion toward the third surface of the capacitor body, and the third internal electrode may include a third body portion overlapping a portion of the fourth internal electrode, and a fourth lead portion extending from the third body portion toward the fourth surface of the capacitor body.

The fourth internal electrode may include first and second grooves formed in both front ends in a direction perpendicular to the fifth and sixth surfaces of the capacitor body, respectively.

The fourth internal electrode may include a 4-1 internal electrode and a 4-2 internal electrode disposed on the second dielectric layer and spaced apart from each other in a direction perpendicular to the third and fourth surfaces of the capacitor body.

The 4-1 internal electrode may overlap a portion of the first and second internal electrodes, and the 4-2 internal electrode may overlap a portion of the first and third internal electrodes.

The first and second external electrodes may extend from the fifth and sixth surfaces of the capacitor body to portions of the first and second surfaces, respectively, and the third and fourth external electrodes may extend from the third and fourth surfaces of the capacitor body to portions of the first and second surfaces, respectively.

The first to fourth external electrodes may further include a plating layer disposed on respective surfaces thereof.

According to an aspect of the present disclosure, a board including a multilayer capacitor mounted thereon includes a board having a plurality of electrode pads on an upper surface thereof; and a multilayer capacitor mounted on the board such that corresponding external electrodes are connected to electrode pads, respectively.

According to an aspect of the present disclosure, a multilayer capacitor includes a capacitor body including a dielectric layer and first and second internal electrode layers respectively disposed on opposing surfaces of the dielectric layer; and first to third external electrodes disposed on the capacitor body and spaced apart from each other. The first internal electrode layer includes first to third internal electrodes respectively connected to the first to third external electrodes. The second internal electrode layer is spaced apart from an outer surface of the capacitor body, and overlaps with each of the first to third internal electrodes in a stacking direction of the first and second internal electrode layers.

The first internal electrode may include: a first body portion overlapping a portion of the second electrode layer; and a first lead portion extending from the first body portion and connecting the first body portion to the first external electrode.

The second internal electrode may include: a second body portion overlapping a portion of the second electrode layer; and a second lead portion extending from the second body

portion and connecting the second body portion to the second external electrode. The third internal electrode may include: a third body portion overlapping a portion of the second electrode layer; and a third lead portion extending from the third body portion and connecting the third body portion to the third external electrode.

The second internal electrode layer may include a groove overlapping a lead portion of the first internal electrode in the stacking direction of the first and second internal electrode layers.

The second internal electrode layer may include a first portion and a second portion spaced apart from each other, the first portion of the second internal electrode layer may overlap with each of the first and second internal electrodes in the stacking direction of the first and second internal electrode layers, and the second portion of the second internal electrode layer may overlap with each of the first and third internal electrodes in the stacking direction of the first and second internal electrode layers.

BRIEF DESCRIPTION OF DRAWINGS

The above and other aspects, features, and advantages of the present disclosure will be more clearly understood from the following detailed description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective diagram illustrating a multilayer capacitor according to an example embodiment of the present disclosure;

FIGS. 2A and 2B are plan diagrams illustrating a structure of an internal electrode applied to the multilayer capacitor illustrated in FIG. 1;

FIG. 3 is an exploded perspective diagram illustrating a laminate structure of first and second dielectric layers illustrated in FIG. 1;

FIG. 4 is a plan diagram illustrating another example embodiment of second and third internal electrodes;

FIG. 5 is a plan diagram illustrating another example embodiment of a fourth internal electrode;

FIG. 6 is a plan diagram illustrating another example embodiment of a fourth internal electrode;

FIG. 7 is an equivalent circuit diagram illustrating a general two-cap type multilayer capacitor having a floating electrode structure;

FIG. 8 is an equivalent circuit diagram illustrating a multilayer capacitor according to an example embodiment of the present disclosure; and

FIG. 9 is a perspective diagram illustrating a board on which the multilayer capacitor illustrated in FIG. 1 is mounted.

DETAILED DESCRIPTION

Hereinafter, embodiments of the present disclosure will be described as follows with reference to the attached drawings.

The present disclosure may, however, be exemplified in many different forms and should not be construed as being limited to the specific embodiments set forth herein.

Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the disclosure to those skilled in the art.

Accordingly, shapes and sizes of elements in the drawings may be exaggerated for clarity of description, and elements indicated by the same reference numeral are same elements in the drawings.

Further, throughout the specification, it will be understood that when a portion “includes” an element, it may further include another element, not excluding another element, unless otherwise indicated.

As for the directions of the hexahedron, in the drawings, X, Y, and Z indicated on the drawings represent a length direction, a width direction, and a thickness direction of the capacitor body, respectively. The thickness direction may be the same as a laminating direction in which first and second dielectric layers are laminated.

FIG. 1 is a perspective diagram illustrating a multilayer capacitor according to an example embodiment. FIGS. 2A and 2B are plan diagrams illustrating a structure of an internal electrode applied to the multilayer capacitor illustrated in FIG. 1. FIG. 3 is an exploded perspective diagram illustrating a laminate structure of first and second dielectric layers illustrated in FIG. 1.

Referring to FIGS. 1 to 3, a multilayer capacitor **100** in the example embodiment may include a capacitor body **110**, a plurality of internal electrodes, and first to fourth external electrodes **131-134**.

The capacitor body **110** may include a plurality of first and second dielectric layers **111** and **112** alternately laminated, and may have a substantially hexahedral shape as illustrated in FIG. 1, but an example embodiment thereof is not limited thereto.

The capacitor body **110** may include first and second surfaces **1** and **2** opposing each other in the Z direction, third and fourth surfaces **3** and **4** and opposing each other in the X direction and connected to the first and second surfaces **1** and **2**, and fifth and sixth surfaces **5** and **6** opposing each other in the Y direction and connected to the first and second surfaces **1** and **2** and the third and fourth surfaces **3** and **4**.

The shape and the dimensions of the capacitor body **110** and the number of the laminated first and second dielectric layers **111** and **112** are not limited to the example illustrated in the drawings.

The first and second dielectric layers **111** and **112** may be in a sintered state, and a boundary between the first and second dielectric layers **111** and **112** adjacent to each other may be integrated such that it may be difficult to identify boundaries therebetween without using a scanning electron microscope (SEM).

The first and second dielectric layers **111** and **112** may include a high-k ceramic material, barium titanate (BaTiO₃) or strontium titanate (SrTiO₃) ceramic powder, for example, but an example embodiment thereof is not limited thereto as long as sufficient capacitance is able to be obtained.

The first and second dielectric layers **111** and **112** may further include ceramic additives, organic solvents, plasticizers, binders, and dispersants in addition to ceramic powder.

As the ceramic additives, a transition metal oxide or a transition metal carbide, a rare earth element, magnesium (Mg) or aluminum (Al) may be used.

In the capacitor body **110**, a plurality of internal electrodes may be disposed and may be separated from each other with the first or second dielectric layers **111** and **112** interposed therebetween.

In the example embodiment, the internal electrodes may include first to fourth internal electrodes **121-124**.

In this case, the first to third internal electrodes **121-123** as one internal electrode layer may be disposed on one first dielectric layer **111** and may be spaced apart from each other, and the fourth internal electrode **124** as another internal electrode layer may be disposed on the second dielectric layer **112** such that the first and second dielectric layers **111**

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and **112** may be alternately disposed in the Z direction. In one example, the first to third internal electrodes **121-123** as one internal electrode layer and the fourth internal electrode **124** as another internal electrode layer may be disposed on opposing surfaces of the first second dielectric layer **111** or opposing surfaces of the second dielectric layer **111**.

In this case, the first internal electrode **121** may be configured as an electrode connected to a ground (GND) terminal, and the second and third internal electrodes **122** and **123** may be configured as electrodes connected to a signal terminal.

The capacitor body **110** may include an active region contributing to the formation of capacitance of the capacitor, and upper and lower cover regions formed above and below the active region in the Z direction as upper and lower margin portions.

The upper and lower cover regions may have a material and a configuration the same as those of the first and second dielectric layers **111** and **112** other than the configuration in which the upper and lower cover regions do not include internal electrodes.

The upper and lower cover regions may be formed by laminating a single dielectric layer or two or more first or second dielectric layers **111** and **112** on upper and lower surfaces of the active region in the Z direction, respectively, and may prevent damages to the internal electrodes caused by physical or chemical stress.

The multilayer capacitor **100** in the example embodiment may include first to fourth external electrodes **131-134** formed on an external side of the capacitor body **110** and selectively and electrically connected to the internal electrodes.

The first and second external electrodes **131** and **132** may be disposed on the fifth and sixth surfaces **5** and **6** of the capacitor body **110**, respectively.

The first and second lead portions of the first internal electrode **121** may be electrically connected to the first and second external electrodes **131** and **132**.

In this case, the first and second external electrodes **131** and **132** may extend to portions of the first and second surfaces **1** and **2** of the capacitor body **110**.

The third and fourth external electrodes **133** and **134** may be disposed on the third and fourth surfaces **3** and **4** of the capacitor body **110**, respectively.

The second internal electrode **122** may be electrically connected to the third external electrode **133**, and the third internal electrode **123** may be electrically connected to the fourth external electrode **134**.

In this case, the third and fourth external electrodes **133** and **134** may extend to portions of the first and second surfaces **1** and **2** of the capacitor body **110**.

The third and fourth external electrodes **133** and **134** may further extend to portions of the fifth and sixth surfaces **5** and **6** of the capacitor body **110** if desired.

The third and fourth external electrodes **143** and **144** may be spaced apart from the first and second external electrodes **131** and **132** by a predetermined distance on the third and fourth surfaces **3** and **4** of the capacitor body **110** to not be in contact with the first and second external electrodes **131** and **132**.

The first to fourth external electrodes **131** to **134** may be formed by a conductive paste including a conductive metal.

The conductive metal may be nickel (Ni), copper (Cu), tin (Sn), or alloys thereof, but an example of the conductive metal is not limited thereto.

A method of forming the first to fourth external electrodes **131-134** is not limited to any particular method, and the first to fourth external electrodes **131-134** may be formed by

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dipping the capacitor body **110** in a conductive paste, for example, and other methods such as sputtering or plating may be used.

Plating layers may be formed on surfaces of the first to fourth external electrodes **131-134**, respectively.

The plating layer may include a nickel plating layer formed on each of the first to fourth external electrodes **131** to **134** and a tin plating layer formed on the nickel plating layer.

The first internal electrode **121** may be disposed on the first dielectric layer **111**, may be exposed to the fifth and sixth surfaces **5** and **6** of the capacitor body **110**, and may be connected to the first and second external electrodes **131** and **132**.

In this case, the first internal electrode **121** may include a first body portion **121a** and first and second lead portions **121b** and **121c**.

The first body portion **121a** may overlap a portion of the fourth internal electrode **124** in the Z direction.

The first lead portion **121b** may extend from the first body portion **121a** to be exposed toward the fifth surface **5** of the capacitor body **110**, and may be connected to the first external electrode **131**.

The second lead portion **121c** may extend from the first body portion **121a** to be exposed toward the sixth surface **6** of the capacitor body **110** and may be connected to the second external electrode **132**.

The second internal electrode **122** may be disposed on the first dielectric layer **111** and may be spaced apart from the first internal electrode **121**, and may be exposed through the third surface **3** of the capacitor body **110** and may be connected to the third external electrode **133**.

The third internal electrode **123** may be disposed on the first dielectric layer **111** and may be spaced apart from the first internal electrode **121**, and may be exposed through the fourth surface **4** of the capacitor body **110** and may be connected to the fourth external electrode **134**.

In this case, the third internal electrode **123** may form a symmetrical structure with the second internal electrode **122** with the first internal electrode **121** in the middle in the X direction.

The fourth internal electrode **124** may be disposed on the second dielectric layer **112** and may be spaced apart from the third to sixth surfaces **3-6** of the capacitor body **110**, and may overlap a portion of the first to third internal electrodes **121-123** in the Z direction. Accordingly, the fourth internal electrode **124** may be configured as a floating electrode.

An intermediate portion of the fourth internal electrode **124** taken in the X direction may overlap the first body portion **121a** of the first internal electrode **121** in the Z direction, and a left end portion taken in the X direction may overlap a portion of the second internal electrode **122** in the Z direction, and a right end portion in the X direction may overlap a portion of the third internal electrode **123** in the Z direction.

The first to fourth internal electrodes **121** to **124** may be formed by a conductive paste including a conductive metal.

The conductive metal is not limited to the above example, and may be formed using a noble metal material such as platinum (Pt), palladium (Pd), palladium-silver (Pd—Ag) alloy, and conductive paste including at least one of nickel (Ni) and copper (Cu).

In this case, as the method of printing the conductive paste, a screen printing method or a gravure printing method may be used, and an example embodiment thereof is not limited thereto.

FIG. 4 is a plan diagram illustrating another example embodiment of second and third internal electrodes.

Referring to FIG. 4, the second internal electrode 122' may include at least one first cutout portion 122c in a portion exposed to the third surface 3 of the capacitor body 110.

In this case, the first cutout portion 122c may be formed at a corner of the portion of the second internal electrode 122' exposed to the third surface 3 of the capacitor body 110.

The first cutout portion 122c may be formed on each of both corners of the second internal electrode 122' in the Y direction, or may be formed on only one corner.

A portion of the second internal electrode 122' exposed to the third surface 3 of the capacitor body 110, especially a corner portion, may substantially protrude in the process of grinding the surface of the capacitor body 110 before the third external electrode 133 is formed.

In this case, after the third external electrode 133 is formed, the second internal electrode 122' may penetrate into the third external electrode 133, or the corner portion of the second internal electrode 122' may protrude out of the third external electrode 133.

The above issue may be prevented by forming the first cutout portion 122c in the second internal electrode 122' as in the example embodiment.

The shape of the first cutout portion 122c of the second internal electrode 122' is not limited to the example illustrated in FIG. 4 and may be varied.

The third internal electrode 123' may include at least one second cutout portion 123c in a portion exposed to the fourth surface 4 of the capacitor body 110.

In this case, the second cutout portion 123c may be formed at a corner of the portion exposed from the third internal electrode 123' to the fourth surface 4 of the capacitor body 110.

The second cutout portion 123c may be formed at each of both corners of the third internal electrode 123' in the Y direction, or may be formed on only one corner.

A portion of the third internal electrode 123' exposed to the fourth surface 4 of the capacitor body 110, especially a corner portion thereof may substantially protrude in the process of grinding the surface of the capacitor body 110 before the fourth external electrode 134 is formed.

In this case, after the fourth external electrode 134 is formed, the third internal electrode 123' may penetrate into the fourth external electrode 134, or the corner portion of the third internal electrode 123' may protrude out of the fourth external electrode 134.

The above issue may be prevented by forming the second cutout portion 123c in the third internal electrode 123' as in the example embodiment.

Also, the shape of the second cut-out portion 123c of the third internal electrode 123' is not limited to the example illustrated in FIG. 4 and may be varied.

In other words, the second internal electrode 122' may include a second body portion 122a overlapping a portion of the fourth internal electrode 124 in the Z direction, and a third lead portion 122b extending toward the third surface 3 of the capacitor body 110 and connected to the third external electrode 133.

In this case, the second internal electrode 122' may be divided into the second body portion 122a and the third lead portion 122b by the first cutout portion 122c.

Also, the third internal electrode 123' may include a third body portion 123a overlapping a portion of the fourth internal electrode 124 in the Z direction, and a fourth lead portion 123b extending toward the fourth surface 4 of the

capacitor body 110 and connected to the fourth external electrode 134 in the third body portion 123a.

In this case, the third internal electrode 123' may be divided into the third body portion 123a and the fourth lead portion 123b by the second cutout portion 123c.

FIG. 5 is a plan diagram illustrating another example embodiment of a fourth internal electrode.

Referring to FIG. 5, the fourth internal electrode 124' may have first and second grooves 124a and 124b formed at both front ends in the Y direction, respectively.

In this case, the first and second groove portions 124a and 124b may be formed in positions overlapping the first and second lead portions 121b and 121c of the first internal electrode 121 in the Z direction, respectively.

The first groove portion 124a may further increase the distance between the front end of the fourth internal electrode 124' and the fifth surface 5 of the capacitor body 110, and the second groove portion 124c may further increase the distance between the front end of the fourth internal electrode 124' and the sixth surface 6 of the capacitor body 110.

In this case, since the positions in which the first and second groove portions 124b and 124c are formed may correspond to the positions in which the first and second external electrodes 131 and 132 are formed, the phenomenon in which the fourth internal electrode 124' is in contact with the first and second lead portions 121b and 121c of the first internal electrode 121 and also the first and second external electrodes 131 and 132 may be prevented such that shorts may be prevented, thereby improving reliability of the multilayer capacitor 100.

Also, the shapes of the first and second grooves 124a and 124b of the fourth internal electrode 124' are not limited to the examples illustrated in FIG. 5 and may be varied.

FIG. 6 is a plan diagram illustrating another example embodiment of a fourth internal electrode.

Referring to FIG. 6, the fourth internal electrode 124" may include a 4-1 internal electrode 1241 and a 4-2 internal electrode 1242 disposed on one second dielectric layer 112 and may be spaced apart from each other in the X direction.

The 4-1 internal electrode 1241 may overlap portions of the first and second internal electrodes 121 and 122, and the 4-2 internal electrode 1242 overlap portions of the first and third internal electrodes 121 and 123.

A space portion in which the 4-1 internal electrode 1241 and the 4-2 internal electrode 1242 are spaced apart from each other in the X direction may correspond to a position in which the first and second external electrodes 131 and 132 are formed, and accordingly, in the process of manufacturing the capacitor, the phenomenon in which the fourth internal electrode 124" is in contact with the first and second lead portions 121b and 121c of the first internal electrode 121 and also the first and second external electrodes 131 and 132 may be prevented such that shorts may be prevented, thereby improving reliability of the multilayer capacitor 100.

To improve withstand voltage properties in a multilayer capacitor, a multilayer capacitor may have a structure in which the first internal electrode is used as a floating electrode, the second internal electrode is configured as two electrodes disposed on one dielectric layer and exposed to the third and fourth surfaces of the capacitor body, respectively, the first and second internal electrodes are alternately laminated, and a pair of external electrodes are disposed on both end surfaces of the capacitor body.

In the case of a general two-cap type multilayer capacitor designed such that the internal electrode has a floating electrode structure, as illustrated in FIG. 7, the two capacitors are configured in series in terms of an equivalent circuit,

such that the withstand voltage properties may increase twice as compared to a multilayer capacitor including a general internal electrode, rather than a floating electrode.

However, in this case, since capacity of the multilayer capacitor may greatly be reduced to $\frac{1}{4}$, and the ESL may increase twice, it may be difficult to apply the multilayer capacitor to a product having high power or high frequency properties.

In the example embodiment, a structure of the floating electrode may be applied to the fourth internal electrode formed on the second dielectric layer, the first and second external electrodes, signal terminals, and the third and fourth external electrodes, ground terminals may be included, the first and second external electrodes may be connected to the first internal electrode formed on the first dielectric layer, and the third and fourth external electrodes may be configured to be connected to the second and third internal electrodes spaced apart from the first internal electrode on the first dielectric layer.

Therefore, as illustrated in FIG. 8, while the withstand voltage properties of the multilayer capacitor may improve in terms of an equivalent circuit, and ESL may be reduced to $\frac{1}{2}$ as compared to the multilayer capacitor illustrated in FIG. 7.

Accordingly, the multilayer capacitor may be applied to a product having high power or high frequency properties.

FIG. 9 is a perspective diagram illustrating a board on which the multilayer capacitor illustrated in FIG. 1 is mounted.

Referring to FIG. 9, a board including a multilayer capacitor mounted thereon in the example embodiment may include a board **210** having first to fourth electrode pads **221-224** disposed on one surface and spaced apart from each other, and a multilayer capacitor **100** mounted such that the first to fourth external electrodes **131-134** may be connected to corresponding first to fourth electrode pads **221-224**, respectively, on one surface of the board **210**.

In FIG. 9, reference numeral **230** denotes solder for bonding the electrode pad and the external electrode.

According to the aforementioned example embodiment, the multilayer capacitor may have a high withstand voltage and may implement low ESL properties.

One element described in a particular example embodiment, even if it is not described in another example embodiment, may be understood as a description related to another example embodiment, unless an opposite or contradictory description is provided therein. For example, a laminate structure may include an internal electrode structure shown in one of FIGS. 2A and 4 and another internal electrode structure shown in one of FIGS. 2B, 5, and 6.

While the example embodiments have been illustrated and described above, it will be apparent to those skilled in the art that modifications and variations could be made without departing from the scope of the present invention as defined by the appended claims.

What is claimed is:

1. A multilayer capacitor, comprising:

a capacitor body including first and second dielectric layers and internal electrodes alternately laminated, and including first and second surfaces opposing each other, third and fourth surfaces opposing each other in a length direction and connected to the first and second surfaces, and fifth and sixth surfaces opposing each other and connected to the first and second surfaces and the third and fourth surfaces;

first and second external electrodes disposed on the fifth and sixth surfaces of the capacitor body, respectively; and

third and fourth external electrodes disposed on the third and fourth surfaces of the capacitor body, respectively, wherein the internal electrodes include:

a first internal electrode disposed on the first dielectric layer and connected to the first and second external electrodes;

a second internal electrode disposed on the first dielectric layer, spaced apart from the first internal electrode, and connected to the third external electrode;

a third internal electrode disposed on the first dielectric layer, spaced apart from the first internal electrode, and connected to the fourth external electrode; and

a fourth internal electrode disposed on the second dielectric layer, spaced apart from the first to fourth external electrodes, and overlapping at least a portion of the first to third internal electrodes,

wherein the second internal electrode has at least one first cutout portion at a front end, adjacent to the third surface of the capacitor body in a direction perpendicular to the third surface of the capacitor body,

wherein the third internal electrode has at least one second cutout portion at a front end, adjacent to the fourth surface of the capacitor body in a direction perpendicular to the fourth surface of the capacitor body,

wherein each of the second and third internal electrodes has a length which is less than $\frac{1}{2}$ a length of the capacitor body in the length direction,

wherein a length between the third and fourth surfaces of the capacitor body is greater than a length between the fifth and sixth surfaces, and

wherein the fourth internal electrode includes first and second grooves in respective central portions of front ends in a direction perpendicular to the fifth and sixth surfaces of the capacitor body, respectively.

2. The multilayer capacitor of claim 1, wherein the first internal electrode includes:

a first body portion overlapping a portion of the fourth internal electrode; and

first and second lead portions extending from the first body portion toward the fifth and sixth surfaces of the capacitor body, respectively.

3. The multilayer capacitor of claim 1, wherein the first cutout portion is on at least one corner, and

wherein the second cutout portion is on at least one corner.

4. The multilayer capacitor of claim 1, wherein the second internal electrode includes a second body portion overlapping a portion of the fourth internal electrode, and a third lead portion extending from the second body portion toward the third surface of the capacitor body, and

wherein the third internal electrode includes a third body portion overlapping a portion of the fourth internal electrode, and a fourth lead portion extending from the third body portion toward the fourth surface of the capacitor body.

5. The multilayer capacitor of claim 1, wherein the first and second external electrodes extend from the fifth and sixth surfaces of the capacitor body to portions of the first and second surfaces, respectively, and

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wherein the third internal electrode includes a third body portion overlapping a portion of the fourth internal electrode, and a fourth lead portion extending from the third body portion toward the fourth surface of the capacitor body, and

wherein the fourth internal electrode has both front ends in a direction perpendicular to the fifth and sixth surfaces of the capacitor body and configured to be flat.

15. A board including a multilayer capacitor mounted thereon, the board comprising:

a board having first to fourth electrode pads on an upper surface thereof; and

the multilayer capacitor of claim **1**, mounted on the board such that the first to fourth external electrodes are connected to the first to fourth electrode pads, respectively.

16. A multilayer capacitor, comprising:

a capacitor body including a dielectric layer and first and second internal electrode layers respectively disposed on opposing surfaces of the dielectric layer; and

first to third external electrodes disposed on the capacitor body and spaced apart from each other,

wherein the first internal electrode layer includes first to third internal electrodes respectively connected to the first to third external electrodes,

the second internal electrode layer is spaced apart from an outer surface of the capacitor body, and overlaps with each of the first to third internal electrodes in a stacking direction of the first and second internal electrode layers,

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wherein the second internal electrode includes:

a second body portion overlapping a portion of the second electrode layer; and

a second lead portion extending from the second body portion in a length direction of the capacitor body and connecting the second body portion to the second external electrode,

wherein the third internal electrode includes:

a third body portion overlapping a portion of the second electrode layer; and

a third lead portion extending from the third body portion in the length direction of the capacitor body and connecting the third body portion to the third external electrode,

wherein each of the second and third internal electrodes has a length which is less than $\frac{1}{2}$ a length of the capacitor body in the length direction of the capacitor body, and

wherein the second internal electrode layer includes a groove overlapping a lead portion of the first internal electrode in the stacking direction of the first and second internal electrode layers.

17. The multilayer capacitor of claim **16**, wherein the first internal electrode includes:

a first body portion overlapping a portion of the second electrode layer; and

a first lead portion extending from the first body portion and connecting the first body portion to the first external electrode.

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